

1. Preface 前言

This Product Specification describes the technique requirements, test procedures and precaution notes of cylindrical type Sodium-ion Rechargeable cell to be supplied to customer by SHENZHEN ASIAR ENERGY TECHNOLOGY COMPANY LIMITED.

本标准规定了由深圳阿西亚新能源科技有限公司生产的钠离子电池的技术要求、测试方法和注意事项。

2. Description 说明

2.1. Product 产品: Sodium-ion Rechargeable cell 可充电钠离子电池

2.2. Model (Type) 电池型号: 32140NS

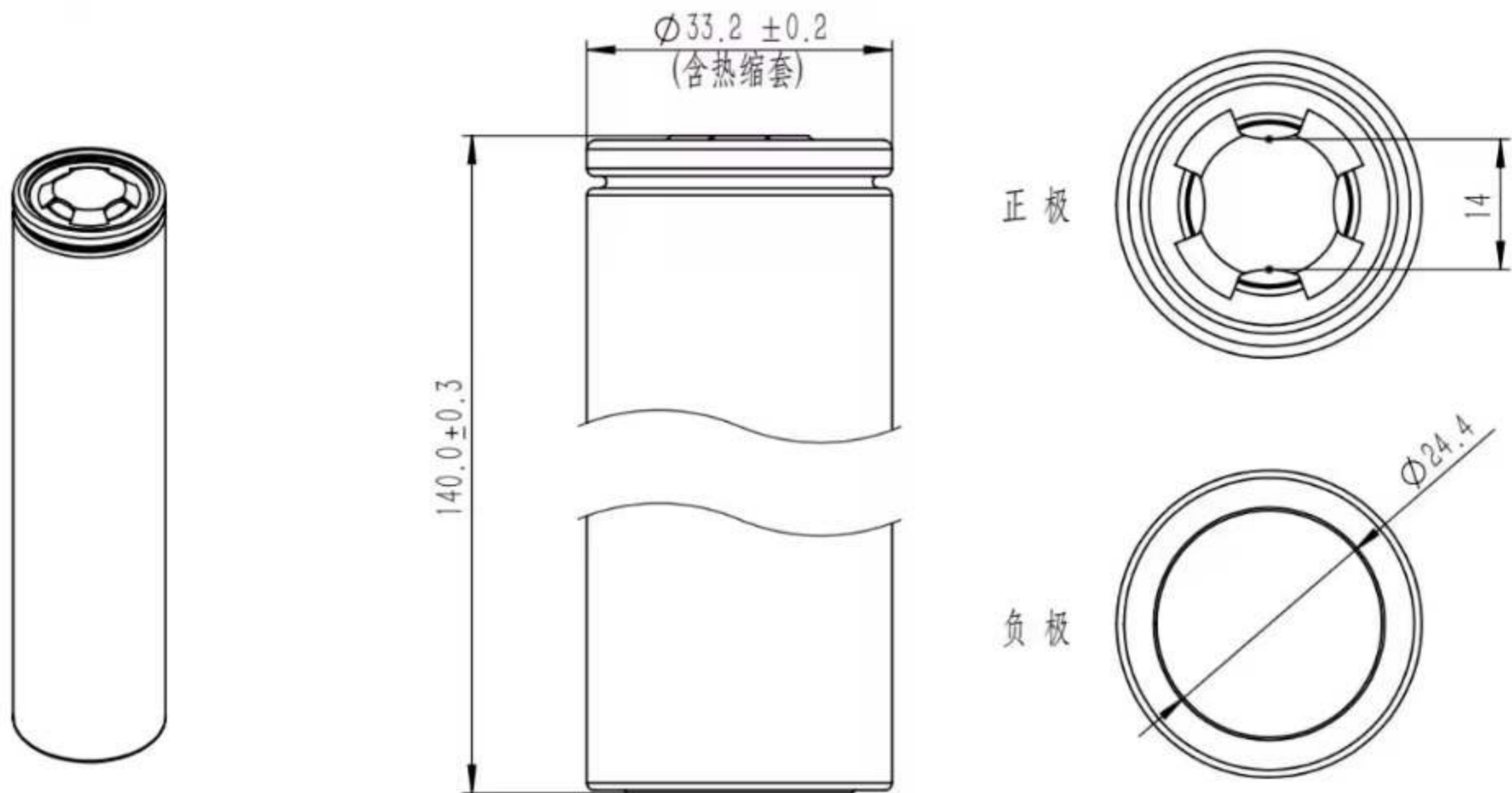
2.3. Designation 名称:

32	140	NS
①	②	③

- ①: Indicates the diameter of cell 代表电池直径  
②: Indicates the overall height of cell 代表电池高度  
③: Indicates the property of the cell 代表电池特性  
The letter "N" defines Sodium-ion series cathode  
"N"代表以“钠离子”材料为正极的体系  
The letter "S" defines cell characteristic code  
"S"代表电池特征编码

3. Cell Size 电池尺寸

For details, please refer to Figure A. Remark: contain PET cover  
对于电池尺寸的详细资讯，请参阅图 A。备注：包含热缩套



4. Construction 电池结构

A cell is made of cathode, anode, separator, steel can and cap, etc.  
电池由正极、负极、隔膜、钢壳和盖帽等组成。

5. Parameters 电池参数

5.1. Summary 概要

Project 项目		Specification 规格	Condition 条件
Nominal Capacity 标称容量		10Ah	25±2°C, 0.5C/0.5C
Minimum Capacity 最小容量		10Ah	
Operating Voltage 工作电压		1.5~3.95V 1.2~3.95V	T>0°C T≤0°C
Nominal Voltage 标称电压		3.0V	/
AC Internal Resistance 交流内阻		2.0mΩ≤IR<5.0mΩ	AC 1kHz, 25% SOC Standard Deviation≤0.2mΩ 标准差≤0.2mΩ
Cell Weight 电池重量		267±10g	contain package 包含外包装
Energy Density 能量密度		112Wh/kg 247Wh/L	/
Operating Temperature 工作温度	Charging Temperature 充电温度	-20~60°C	No matter what charging and discharging mode the cell is in, once the cell surface temperature exceeds this range, the charging and discharging should be stopped. 无论电池处在何种充放电模式，一旦发现电池表面温度超过此范围即停止充放电
	Discharge Temperature 放电温度	-40~60°C	
Storage Temperature 存储温度		-20~45°C	3 months (3 个月)
		-10~25°C	6 months (6 个月)
Cycle Life 循环寿命	Standard Cycle 标准循环	≥2000 cycles	25±2°C, 0.5C/0.5C, 80% SOH
	Fast Charge Cycle 快充循环	≥2500 cycles	25±2°C, fast charge/1C discharge, 70% SOH 25±2°C, 快充充电方案/1C 放电, 70% SOH
Appearance 外观		Without break, scratch, distortion, contamination, leakage and so on 无破裂、划痕、变形、污迹、电解液泄露等	

**5.2. Charging Parameters 充电参数**

Project 项目	Specification 规格		Condition 条件			
Standard Charging Mode 标准充电模式	0.5C CC/CV, cut off 3.95V/0.05C 0.5C 恒流恒压充电至 3.95V/0.05C 截止					
Standard Charging Current 标准充电电流	0.5C		/			
Max. Continuous Charging Current 最大持续充电电流	-10~0℃	0~10℃	10~20℃	20~45℃	45~50℃	50~60℃
	0.2C	0.33C	0.5C	1C	0.5C	0.2C
Standard End-of-charge Voltage 标准充电截止电压	3.95V		/			
Max. End-of-charge Voltage 最大充电截止电压	3.95V		No matter what charging mode the cell is in, once the cell voltage exceeds this range, the charging should be stopped. 无论电池处在何种充电模式，一旦发现电池电压超过此范围即停止充电			
Fast Charge Charging Time 快充充电时间	30min		30%~80% SOC， 25℃			
Optimum Charging Temperature Range 最佳充电温度范围	15~40℃		cell surface temperature 电池表面温度			
Max. Charging Temperature Range 最大允许充电温度范围	-20~60℃		No matter what charging mode the cell is in, once the cell surface temperature exceeds this range, the charging should be stopped. 无论电池处在何种充电模式，一旦发现电池表面温度超过此范围即停止充电			

**5.3. Discharge Parameters 放电参数**

Project 项目	Specification 规格	Condition 条件
Standard Discharge Mode 标准放电模式	0.5C CC, cut off 1.5V 0.5C 恒流放电至 1.5V 截止	
Standard Discharge Current 标准放电电流	0.5C	/
Max. Continuous Discharge Current 最大持续放电电流	3C	15~45℃
Max. Discharge Pulse Current 最大脉冲放电电流	10C (10s)	15~45℃
End-of-discharge Voltage 放电截止电压	1.5V	/
Max. Discharge Temperature Range 最大允许放电温度范围	-40~60℃	No matter what discharge mode the cell is in, once the cell surface temperature exceeds this range, the discharge should be stopped. 无论电池处在何种放电模式，一旦发现电池表面温度超过此范围即停止放电

## 5.4. Pulse Parameters 脉冲参数

### 5.4.1. Regen Pulse Current 脉冲充电电流

30s Regen Pulse Current Map-Cell Level (Unit: A) 30s 脉冲充电电流 Map-电芯级别 (单位: A)												
SOC Temp.	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
55°C	23.0	18.5	15.5	13.5	12.0	11.0	11.0	9.0	8.5	8.5	7.0	1.0
50°C	29.0	29.0	27.0	20.5	17.5	16.5	16.5	13.5	12.0	12.0	10.0	2.0
45°C	38.0	38.0	38.0	38.0	29.0	25.5	21.5	18.5	17.5	16.5	14.5	3.0
40°C	38.0	38.0	38.0	38.0	27.5	23.0	20.5	17.5	16.5	15.5	14.5	3.0
30°C	38.0	38.0	38.0	29.5	22.0	20.0	20.0	16.5	15.5	15.5	13.5	1.5
25°C	38.0	38.0	38.0	28.0	20.5	18.5	18.5	16.5	15.5	14.5	13.5	1.5
20°C	28.0	26.0	23.0	20.0	17.5	15.5	15.5	13.5	13.5	12.0	11.5	2.0
10°C	21.5	21.5	20.0	16.5	14.5	13.5	12.0	11.5	10.0	10.0	9.5	2.0
5°C	16.5	16.5	14.5	12.0	11.5	10.5	10.5	9.0	8.5	8.5	7.5	1.0
0°C	13.5	13.5	11.5	10.0	9.0	8.5	8.5	7.0	5.5	5.5	5.0	0.5
-10°C	5.5	5.5	5.0	4.5	3.5	3.0	3.0	1.5	1.5	2.0	1.5	0.5

### 5.4.2. Discharge Pulse Current 脉冲放电电流

30s Discharge Pulse Current Map-Cell Level (Unit: A) 30s 脉冲放电电流 Map-电芯级别 (单位: A)												
SOC Temp.	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	100%
55°C	32.0	32.0	32.0	32.0	32.0	32.0	32.0	34.5	35.5	35.5	35.5	35.5
50°C	40.0	46.0	46.0	46.0	46.0	46.0	46.0	48.5	50.5	50.5	50.5	50.5
45°C	46.5	55.0	55.0	55.0	55.0	55.0	55.0	57.5	61.0	61.0	61.0	61.0
40°C	48.0	65.0	65.5	66.0	66.0	66.0	66.0	69.5	72.0	72.0	72.0	72.0
30°C	36.5	57.5	61.0	66.0	66.0	66.0	66.0	69.5	72.0	72.0	72.0	72.0
25°C	30.5	50.0	57.5	66.0	66.0	66.0	66.0	69.5	72.0	72.0	72.0	72.0
20°C	21.5	40.0	52.5	66.0	66.0	66.0	66.0	69.5	72.0	72.0	72.0	72.0
10°C	13.5	17.0	34.0	54.5	57.5	57.5	57.5	61.0	63.5	63.5	63.5	63.5
5°C	10.0	17.0	29.5	44.0	51.5	52.5	52.5	55.5	59.5	59.5	59.5	59.5
0°C	6.5	13.5	24.0	38.0	47.5	47.5	47.5	49.0	51.0	55.0	55.0	55.0
-10°C	5.0	10.0	17.0	30.5	32.5	34.0	38.0	38.0	40.5	40.5	44.5	44.5
-20°C	3.0	4.0	8.5	15.0	22.0	27.0	27.0	30.5	35.5	35.5	35.5	35.5

6. Electrical Performance 电性能

Project 项目		Specification 规格	Condition 条件
Discharge Capacity Retention Rate at Different Temperatures 高低温性能	55°C/25°C	≥100%	55±2°C, 0.5C, cut off 1.2V Based on 10Ah 基准为 10Ah
	0°C/25°C	≥95%	0±2°C, 0.5C, cut off 1.2V Based on 10Ah 基准为 10Ah
	-10°C/25°C	≥90%	-10±2°C, 0.5C, cut off 1.2V Based on 10Ah 基准为 10Ah
	-20°C/25°C	≥85%	-20±2°C, 0.5C, cut off 1.2V Based on 10Ah 基准为 10Ah
Discharge Capacity Retention Rate at Different Rates 倍率性能	1C/0.5C	≥98%	25±2°C, 1C
	2C/0.5C	≥98%	25±2°C, 2C
High Temperature Storage 高温存储	Charge Retention Rate 荷电保持率	≥90%	55±2°C, 7 days, 0.5C/0.5C
	Capacity Recovery Rate 容量恢复率	≥95%	
Normal Temperature Storage 常温存储	Charge Retention Rate 荷电保持率	≥92%	25±2°C, 28 days, 0.5C/0.5C
	Capacity Recovery Rate 容量恢复率	≥96%	

7. Safety Performance 安全性能

Project 项目	Test Method 测试方法	Inspection Standard 检验标准
Forced-discharge Test 过放电	详见 8.4.1 (GB 38031 8.1.2)	No fire, no explosion. 电池应不起火、不爆炸
Overcharge Test 过充电	详见 8.4.2 (GB 38031 8.1.3)	No fire, no explosion. 电池应不起火、不爆炸
Short-circuit Test 外部短路测试	详见 8.4.3 (GB 38031 8.1.4)	No fire, no explosion. 电池应不起火、不爆炸
Heating Test 加热测试	详见 8.4.4 (GB 38031 8.1.5)	No fire, no explosion. 电池应不起火、不爆炸
Temperature Test 温度循环测试	详见 8.4.5 (GB 38031 8.1.6)	No fire, no explosion. 电池应不起火、不爆炸
Crush Test 挤压测试	详见 8.4.6 (GB 38031 8.1.7)	No fire, no explosion. 电池应不起火、不爆炸
Drop Test 跌落测试	详见 8.4.7 (GB/T 31485 6.1.5)	No leakage, no fire, no explosion 电池应不漏液、不起火、不爆炸
Impact Test 重物冲击测试	详见 8.4.8 (UL 1642 14)	No fire, no explosion. 电池应不起火、不爆炸
Vibration Test 振动测试	详见 8.4.9 (UL 1642 16)	No leakage, no fire, no explosion 电池应不漏液、不起火、不爆炸

Low-pressure Test 低气压测试	详见 8.4.10 (UL1642 19)	No leakage, no fire, no explosion 电池应不漏液、不起火、不爆炸
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## 8. Test Method 测试方法

### 8.1. Standard Test Conditions 标准测试条件

Unless otherwise specified, all tests stated in this Specification are conducted at temp.  $25\pm 2^{\circ}\text{C}$  and humidity 15-90%RH with fresh cell.

若无特别要求，此规格书上的产品测试条件均为温度： $25\pm 2^{\circ}\text{C}$ ，湿度：15-90%RH，新电池状态。

### 8.2. Standard Charge and Discharge Method 标准充放电制式

The "Standard Charge" means charging the Cell at a constant current of 0.5C until the voltage is 3.95V, then charged at a constant voltage of 3.95V until its current is less than 0.05C.

“标准充电制式”即以恒定电流 0.5C 充电至 3.95V，再以 3.95V 恒压充电至电流小于 0.05C。

The "Standard Discharge" means discharging the Cell at a constant current of 0.5C until the voltage is 1.5V.

“标准放电制式”即以恒定电流 0.5C 放电至 1.5V。

### 8.3. Electrical Performance Test 电性能测试

#### 8.3.1 Discharge Capacity Test at Different Temperatures 高低温性能测试

A cell is charged in accordance with Standard Charge, and stored in a constant temperature box at the corresponding temperature for 4 hours, then discharged at a constant current of 0.5C to 1.5V.

电池按标准充电制式充电结束后，放入对应温度的恒温箱中恒温 4 小时，然后以 0.5C 恒流放电至 1.5V。

#### 8.3.2 Discharge Capacity Test at Different Rates 倍率性能测试

A cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged to cut-off voltage of 1.5V at a constant current of 0.5C, after that, stored 30min; then the cell is charged and discharged as above except that at a discharged constant current of 1C; then the cell is charged and discharged as above except that at a discharged constant current of 2C.

电池按标准充电制式充电结束后搁置 30min，然后以 0.5C 恒流放电至 1.5V，放电结束后搁置 30min；这颗电池继续进行下一次充放电循环，需以 1C 进行恒流放电；继续进行下一次充放电循环，需以 2C 进行恒流放电。

#### 8.3.3 High Temperature Storage Performance Test 高温存储性能测试

A cell is charged in accordance with Standard Charge, and stored in  $55\pm 2^{\circ}\text{C}$  for 7d, after that stored for 5 hours at room temperature, then discharged in accordance with Standard Discharge. After that, stored for 30min, the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharge.

电池按标准充电制式充电结束后，将电池在  $55\pm 2^{\circ}\text{C}$  搁置 7 天，然后在室温下搁置 5 小时，再以标准放电制式放电，放电结束后搁置 30min；然后以标准充电制式充电结束后搁置 30min，再以标准放电制式放电。

#### 8.3.4 Normal Temperature Storage Performance Test 常温存储性能测试

A cell is charged in accordance with Standard Charge, and stored in Standard Test Conditions for 28d, then discharged in accordance with Standard Discharge. After that stored for 30min, the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharge.

电池按标准充电制式充电结束后，在标准测试条件下，将电池搁置 28 天，再以标准放电制式放电，放电结束后搁置 30min；此电池标准充电制式充电结束后，搁置 30min，然后以标准放电制式放电。

#### 8.3.5 Standard Cycle Life Test 标准循环寿命测试

At Temp.  $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ , a cell is charged at a constant current of 0.5C until the voltage is 3.95V, then charged at a constant voltage of 3.95V until its current is less than 0.05C, after that stored for 30min; then discharged at a constant current of 0.5C until the voltage is 1.5V, after that, stored 30min prior to next charge-discharge cycle. The charge and discharge cycle is carried out until the capacity retention rate is reduced to 80%.

温度  $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ，电池以 0.5C 恒流充电至 3.95V，以 3.95V 恒压充电至电流小于 0.05C，结束后搁置 30min，然后

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以 0.5C 恒流放电至 1.5 V, 放电结束后搁置 30min, 再进行下一次充放电循环, 直到容量保持率降低至 80%。

### **8.3.6 Fast Charge Cycle Life Test 快充循环寿命测试**

At Temp.:  $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ , a cell is charged by fast charge solution, after that stored for 30min; then discharged at a constant current of 1C until the voltage is 1.5V, after that, stored 30min prior to next charge-discharge cycle. The charge and discharge cycle is carried out until the capacity retention rate is reduced to 70%.

温度  $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ , 电池以快充充电方案进行充电, 结束后搁置 30min, 然后以 1C 恒流放电至 1.5V, 放电结束后搁置 30min, 再进行下一次充放电循环, 直到容量保持率降低至 70%。

## **8.4. Safety Performance Test 安全性能测试**

All below tests are carried out on the equipment with forced ventilation and explosion-proof device. Before test, all cells are charged in accordance with Standard Charge, and stored 1 hours prior to testing.

下述试验应在有强制排风条件及防爆措施的装置内进行, 在试验前所有的电池都按标准充电制式充电, 并搁置 1 小时后, 再进行以下试验。

### **8.4.1 Forced-discharge Test 过放电 (GB 38031 8.1.2)**

A cell is discharged at a constant current of 1C until the discharge time reaches 90min, then observed the cell for 1h.

电池以 1C 电流放电, 直至放电时间到达 90min, 观察 1 小时。

### **8.4.2 Overcharge Test 过充电 (GB 38031 8.1.3)**

A cell is charged in accordance with Standard Charge, then charged the cell up to 4V or 115% SOC at CC of 1C, then observed the cell for 1h.

电池按标准充电制式充电结束后, 对电池以 1C 恒流充电至 4V 或 115% SOC 后停止充电, 观察 1 小时。

### **8.4.3 Short-circuit Test 外部短路测试 (GB 38031 8.1.4)**

Short circuit the positive terminal and negative terminal of the cell externally for 10min (external line resistance  $<5\text{m}\Omega$ ), then observe for 1h.

将电池正极端子和负极端子经外部短路 10min (外部线路电阻 $<5\text{m}\Omega$ ), 观察 1 小时。

### **8.4.4 Heating Test 加热测试 (GB 38031 8.1.5)**

A cell is heated in a circulating air oven. The temperature of the oven is raised at a rate of  $5^{\circ}\text{C}\pm 2^{\circ}\text{C}$  per minute to a temperature of  $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$  and remain for 30min at that temperature before the test is discontinued, then observed the cell for 1h.

将电池放在电热鼓风干燥箱中, 温度以  $5^{\circ}\text{C}\pm 2^{\circ}\text{C}/\text{min}$  的速率由室温升至  $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$  并保持 30min 后停止加热, 观察 1 小时。

### **8.4.5 Temperature Test 温度循环测试 (GB 38031 8.1.6)**

A cell is charged in accordance with Standard Charge, heated the cell in an oven. In 60min, the temperature of the oven is dropped to the temperature of  $-40^{\circ}\text{C}$  and remain for 90min at  $-40^{\circ}\text{C}$ ; In 60min, the temperature of the oven is raised to the temperature of  $25^{\circ}\text{C}$ ; In 90min, the temperature of the oven is raised to the temperature of  $85^{\circ}\text{C}$  and remain for 110min at  $85^{\circ}\text{C}$ ; In 70min, the temperature of the oven is dropped to the temperature of  $25^{\circ}\text{C}$ ; Repeat this for 5 cycles, after that observed the cell for 1h.

电池按标准充电制式充电结束后, 将电池放入温控箱内, 在 60 分钟内, 温控箱温度降至 $-40^{\circ}\text{C}$ , 并在 $-40^{\circ}\text{C}$ 温度下保持 90min; 在 60 分钟内, 温控箱温度升至  $25^{\circ}\text{C}$ ; 在 90 分钟内, 温控箱温度升至  $85^{\circ}\text{C}$ , 并在  $85^{\circ}\text{C}$  温度下保持 110min; 在 70 分钟内, 温控箱温度降至  $25^{\circ}\text{C}$ ; 重复以上步骤 5 次, 观察 1h, 目测电池外观。

### **8.4.6 Crush Test 挤压测试 (GB 38031 8.1.7)**

A cell is to be placed on the crush surface, the axis is parallel to the crush surface, it is to be crushed between two flat surfaces. The pressure is gradually increased at an extrusion speed of  $\leq 2\text{mm/s}$  until the voltage reaches 0V or the deformation reaches 15% or the squeezing force reaches 100kN or 1000 times the weight of the cell, keep the pressure for 10 minutes, and observe for 1 hour.

电池放在挤压设备的两个挤压面之间, 圆柱电池芯轴平行于挤压平面, 以 $\leq 2\text{mm/s}$  的挤压速度, 逐渐增加压力至电压达到 0V 或变形量达到 15%或挤压力达到 100kN 或 1000 倍电池重量, 保持压力 10min, 观察 1 小时。

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#### 8.4.7 Drop Test 跌落测试 (GB/T 31485 6.1.5)

A cell is charged in accordance with Standard Charge, then dropped the cell from a height of 1.5m to the concrete ground with positive and negative terminals downward, then observed the cell for 1h.

电池按标准充电制式充电结束后，将电池样品的正负极端子向下由高度为 1.5m 的位置自由跌落到水泥地面上，观察 1 小时。

#### 8.4.8 Impact Test 重物冲击测试 (UL 1642 14)

A cell is to be placed on the impact flat. A  $\Phi 15.8\text{mm}$  bar is to be placed on the center of the cell. A 9.1kg weight is to be dropped from a height of 610mm onto the cell, the distortion is allowed.

将电池放在冲击台上，将一个  $\Phi 15.8\text{mm}$  的钢柱置放电池中心，钢柱的纵轴平行于平面，让重量 9.1kg 重锤自 610mm 高度自由落下，冲击电池，电池允许发生变形。

#### 8.4.9 Vibration Test 振动测试 (UL 1642 16)

A cell is charged in accordance with Standard Charge, then installed onto the vibration desk with clamps. Equipment parameters of frequency and amplitude are as follows (the frequency is varied at the rate of 1Hz/min between 10 and 55 hertz, and repeat vibration for 90-100min, amplitude: 0.16mm. The cell is tested in three mutually perpendicular directions).

电池按标准充电制式充电结束后，将电池用夹具安装在振动台的台面上，按下面的振动频率和对应的振幅调整好实验设备。X、Y、Z 三个方向每个方向上从 10~55Hz 循环扫频振动 90-100min，扫频速率为 1Hz/min，位移幅值(单振幅): 0.16mm。

#### 8.4.10 Low-pressure Test 低气压测试 (UL1642 19)

A cell is charged in accordance with Standard Charge, then stored it for 6 hours at an absolute pressure of 11.6kPa, then check cell's appearance.

电池按标准充电制式充电结束后，将电池放入在绝对压力为 11.6kPa 下搁置 6 小时，目测电池外观。

## 9. Packaging and Shipment 包装出货

### 9.1. Packaging 包装

Each box is loaded with 40pcs batteries, and the RoHS logo and the finished battery identity card are posted on the outside of the box, as shown in Figure B.

每箱装入 40pcs 电池，箱体外部张贴 RoHS 标识及成品电池标识卡，如图 B 所示。



Figure B (图 B)

The cardboard has 15 boxes per layer, stacking  $\leq 5$  layers, as shown in Figure C.  
卡板每层 15 个箱子，堆叠  $\leq 5$  层，如图 C 所示。

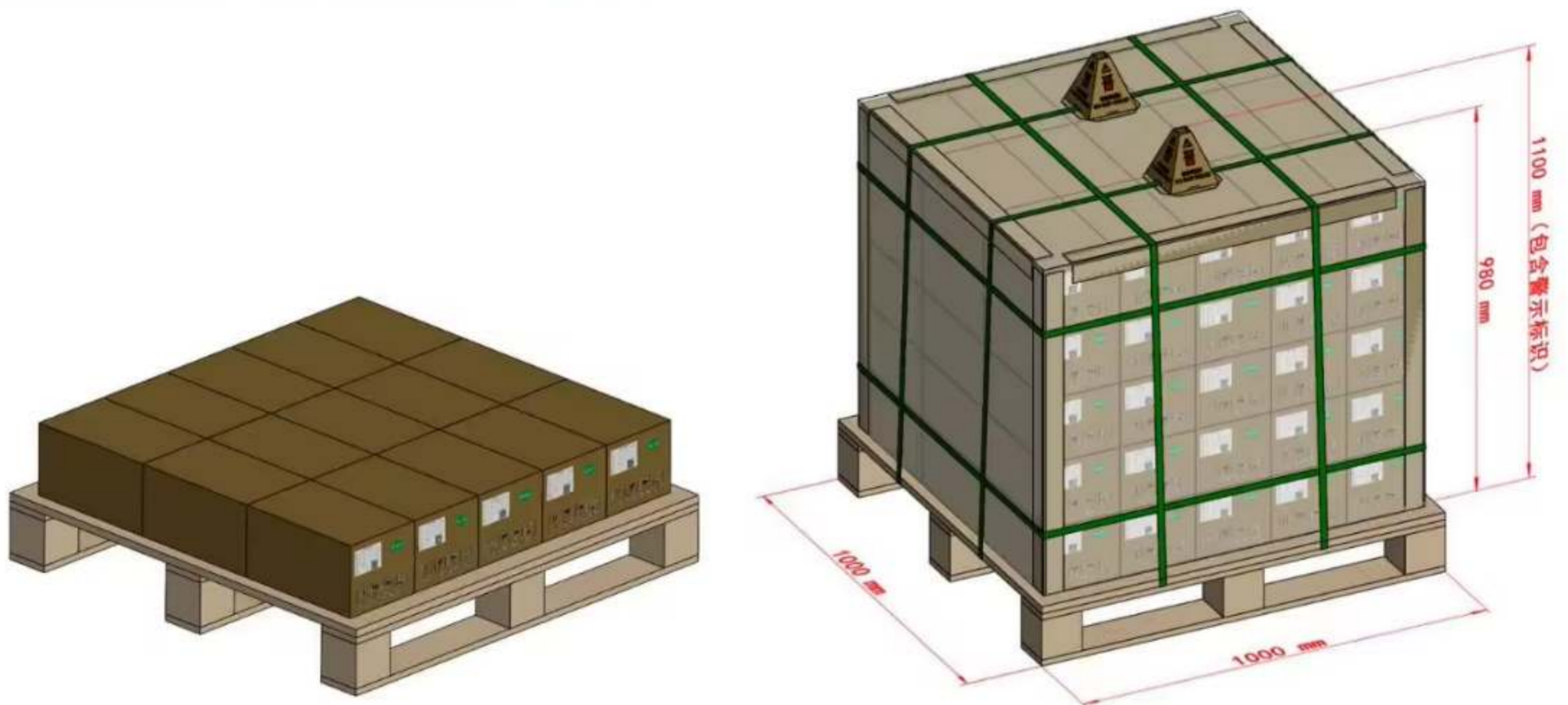


Figure C (图 C)

## 9.2. Shipment 出货

The Cell shall be shipped in 20-30% state-of-charge (SOC) or in accordance with customers' requirement. The remaining capacity of the cell after shipment and before charging depends on the storage time and conditions.

单体电池按 20-30% 的充电容量或客户要求出货，电池出货后充电前的剩余容量取决于储存时间和条件。